pass2: Field-on version

Data: B field on 1243 subruns (February 4-5)

What to study: track - emcal matching

3925471 - events in ntuple

3925471 - no any requirements on the beam track

25882649 - number of vertexes

1607461 - vertexes within target location

2724281 - total number of OutTracks

2370985 - tracks with the right timing (87$\%$)

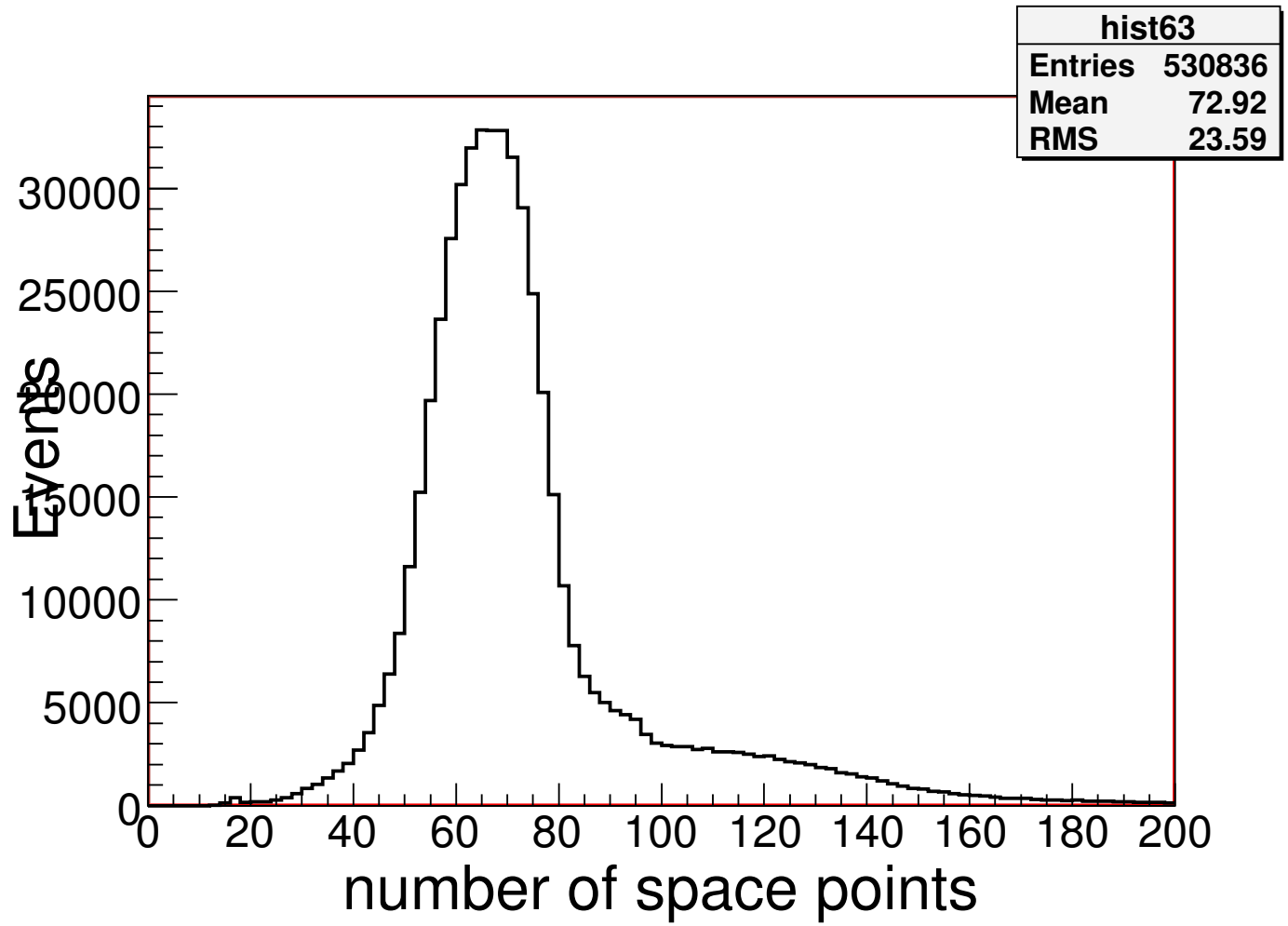
2233262 - track has TPC space points(94$\%$)

842847 - tracks with the DC4, PWC5 and PWC6 hits (38$\%$)

734813 - tracks within EMCAL aperture $|trk_{x,y}|$ <75 cm (87$\%$)

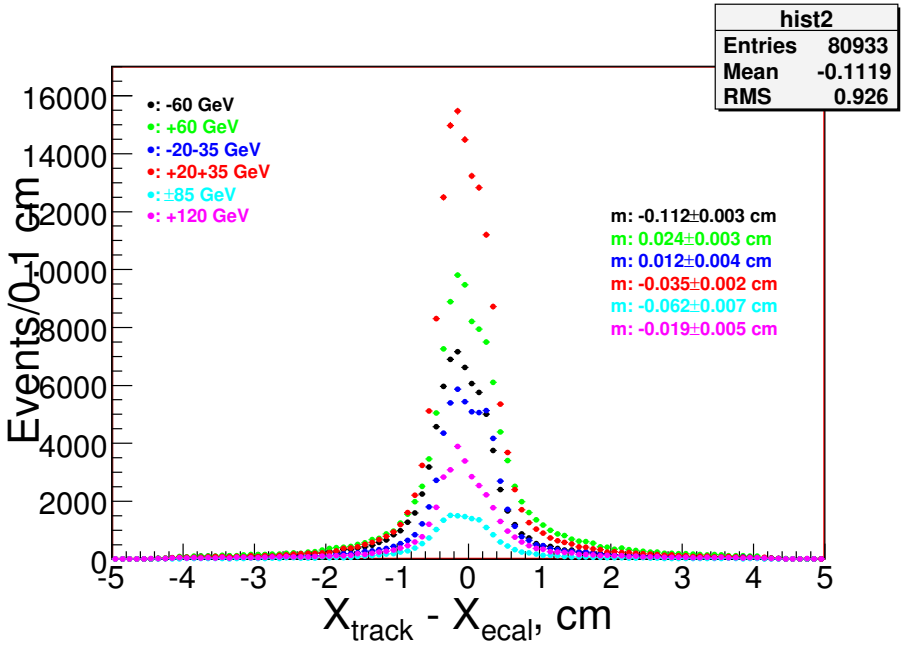
530836 - track momentum $>$ 18 GeV (less multiple scattering) (72$\%$)

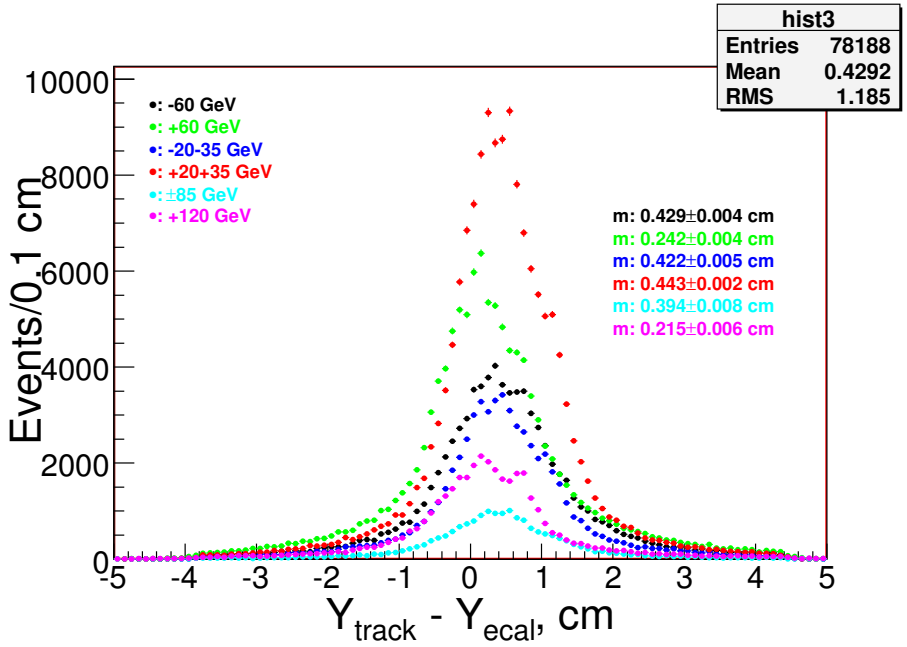
NSpacePoints



The number of space points (TPC hits) on tracks, which passed the selection cuts.

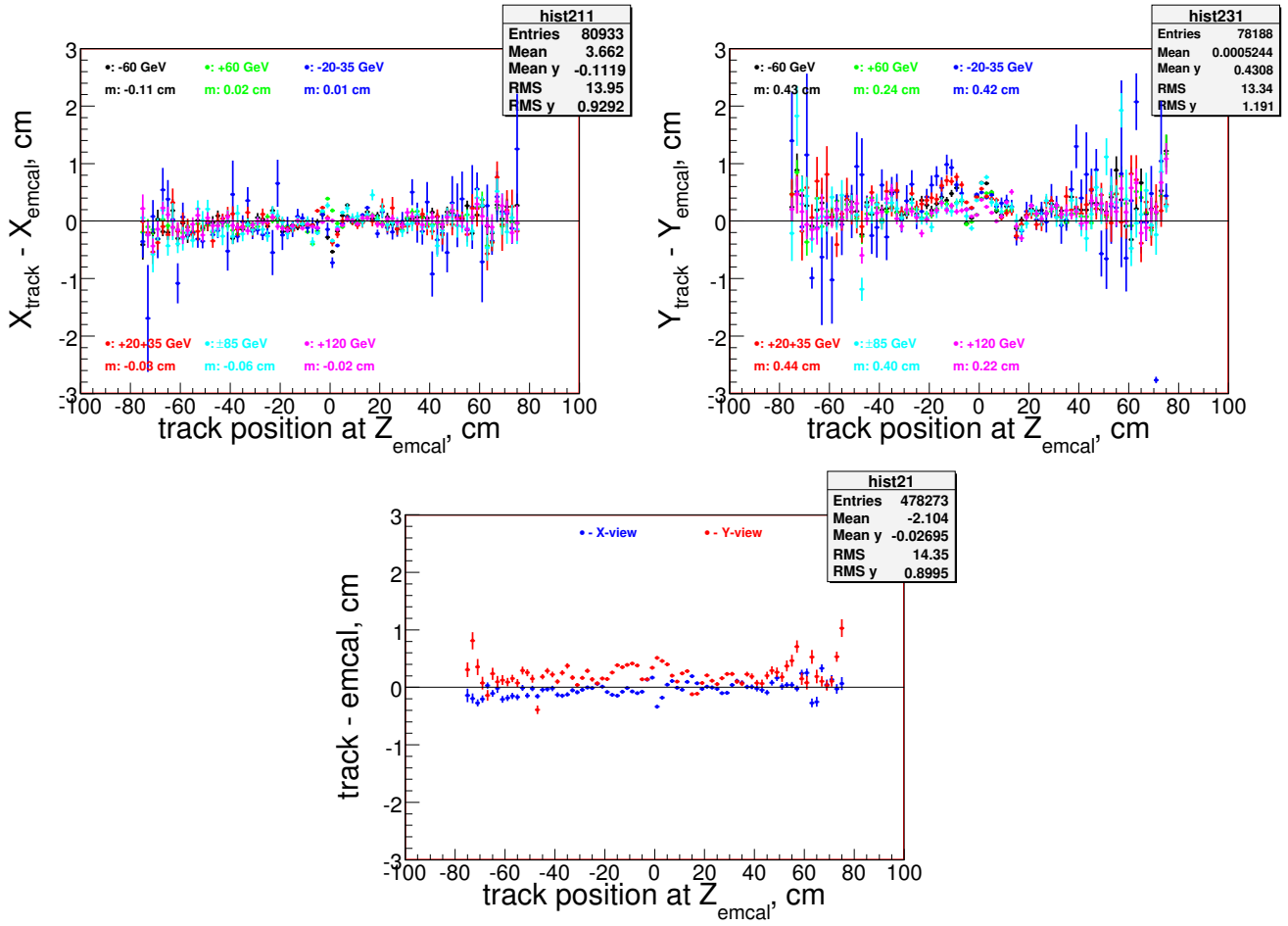
track - shower position differences





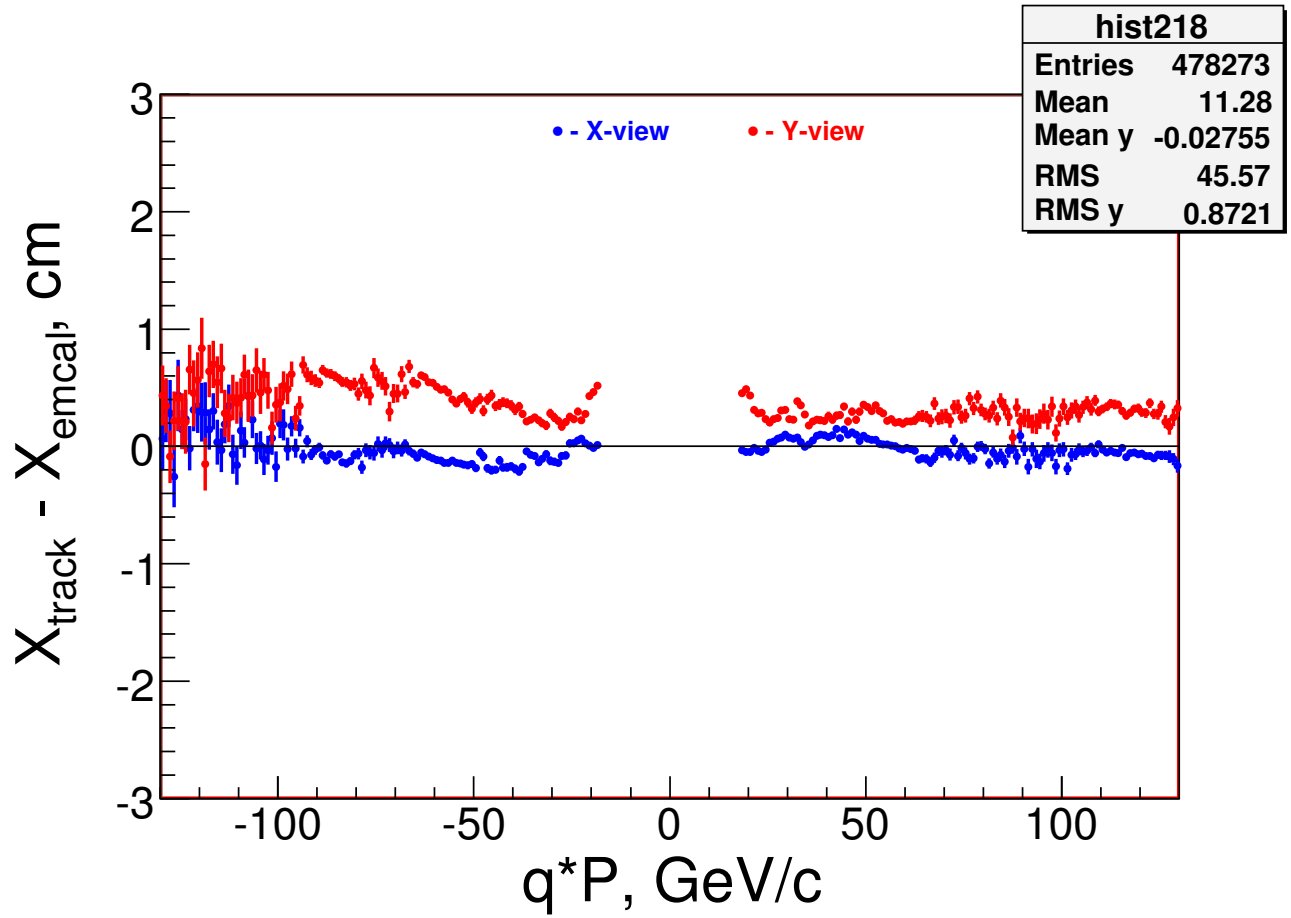
The track - shower residuals distributions for the different beam settings. The matching requirement depends on how the track position is far from the center (in order to take in account the multiple scattering). Δd <4 cm at center, additional 2.5 mm for every 10 cm away from center. Data in X-view looks at the center, but in Y-view it is off by 3-4 mm. I assume that it is due to of the alignment update. B field off results: in X - no offset, in Y - offset within 1 mm. Note: the residuals in Y-view is wider than in X-view by factor 2. I need to use the individual match window for each view.

mean of track-emcal vs projection



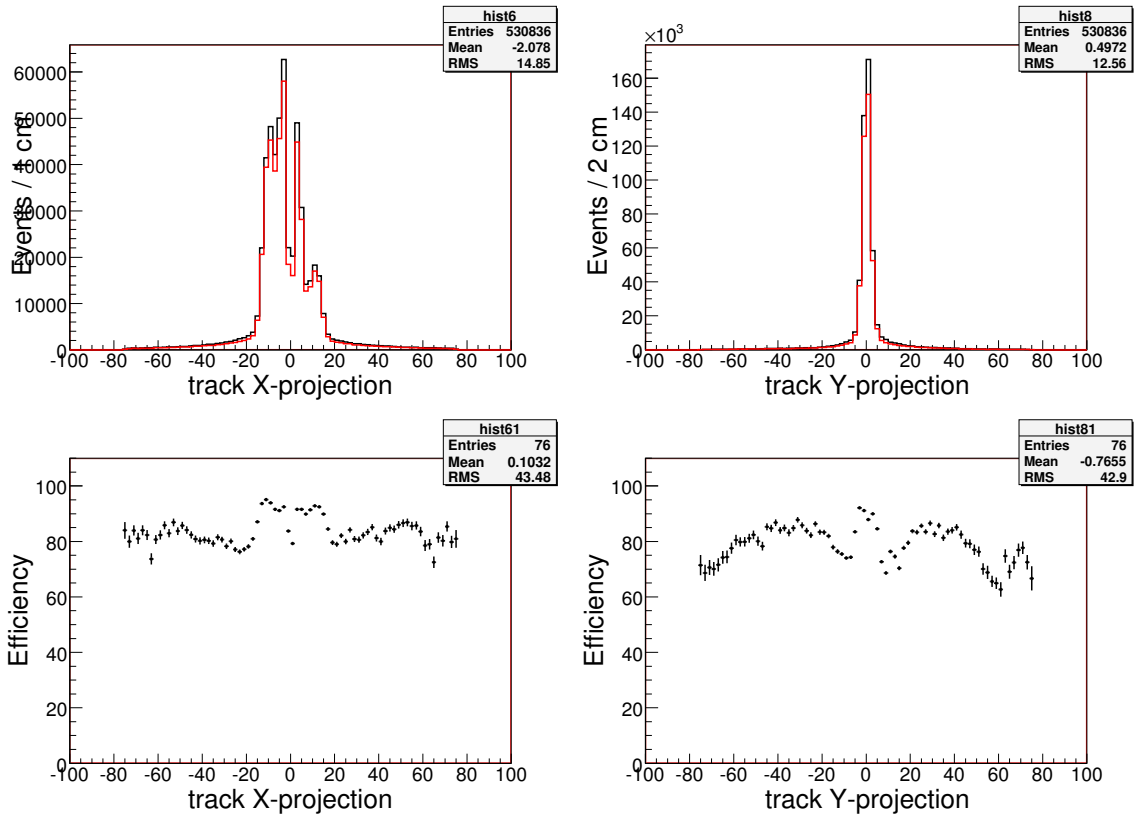
The mean of the X_{track}-X_{emcal} (top left) and Y_{track}-Y_{emcal} (top right) distributions vs the track projections. Top plots - data broken for the different the beam settings: -60, +60, -20-35, +20+35, 85 and +120 GeV/c. The bottom plot - whole data.

residuals vs qP



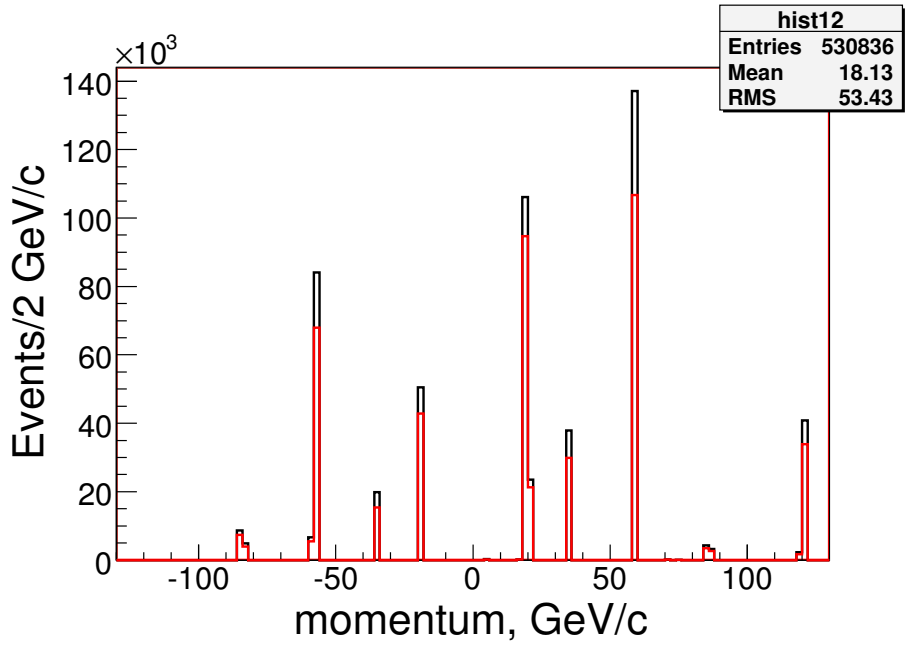
The residuals distributions vs measured qP of tracks: blue - in X-view, red - in Y-view. X-view data demonstrate no qP dependence, while Y-view data has the offset, which depends on the track polarity.

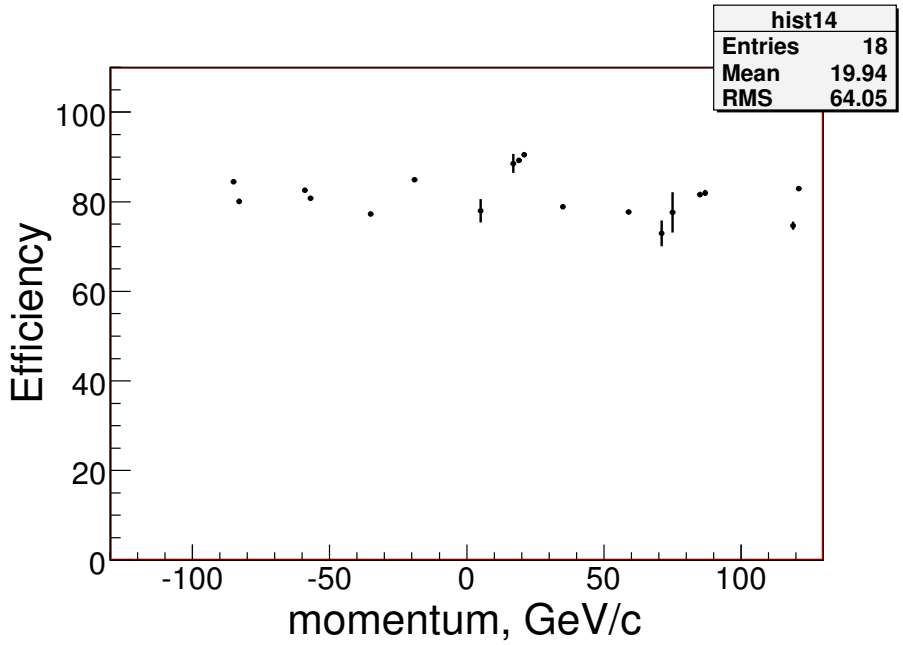
track - shower match efficiencies



Top black plots - track projections at Z_{emcal}. The red plots - same projections but when the match is on. Bottom plots: the track - emcal matching efficiencies (red / black ratio). The points within the beam spot (at center) presenting the tracks with the high momentum. Data away from center representing the relatively soft tracks when the multiple scattering is more likely. There is a strange efficiency behavior in Y-view data. It exist also in the B field off data. Possible explanation: the track projections in Y-view is less accurate than in X-view. Also there are some gaps between the EMCAL chambers.

run momentum





Left plot: black - the tracks within EMCAL aperture vs the run momentum, red - same variable but match is on in both views.

Right plot: the track-emcal matching efficiency vs the run momentum (red / black ratio). The efficiency looks uniform vs the run momentum.

summary

The track projection and emcal shower position are matching to each other within the fraction of mm in X-view and within 3-4 mm in Y-view. Offset in Y-view is due to of the alignment update

Matching efficiency has the position dependence within 10% in both views. It is higher at the center (the beam spot) and lower away from center. Possible explanations: the gaps between the EMCAL chambers, the multiple scattering, Y-view projection in compare with X-view is less accurate.

The combined shower development, reconstruction and the track - emcal matching probability is 80-85%. The matching inefficiency happen partially due to of the multiple scattering of the tracks.